



**NSF SASS workshop 2007**

# **The Impact of Changes in Arctic Sea Ice on the Marine Planktonic Ecosystem – Synthesis and Modeling of Retrospective and Future Conditions**

***UW: Jinlun Zhang, Mike Steele***

***OSU: Yvette Spitz, Leo Berline***

***WHOI: Carin Ashjian***

***URI: Robert Campbell***

***<http://psc.apl.washington.edu/zhang/BIOMAS/index.html>***

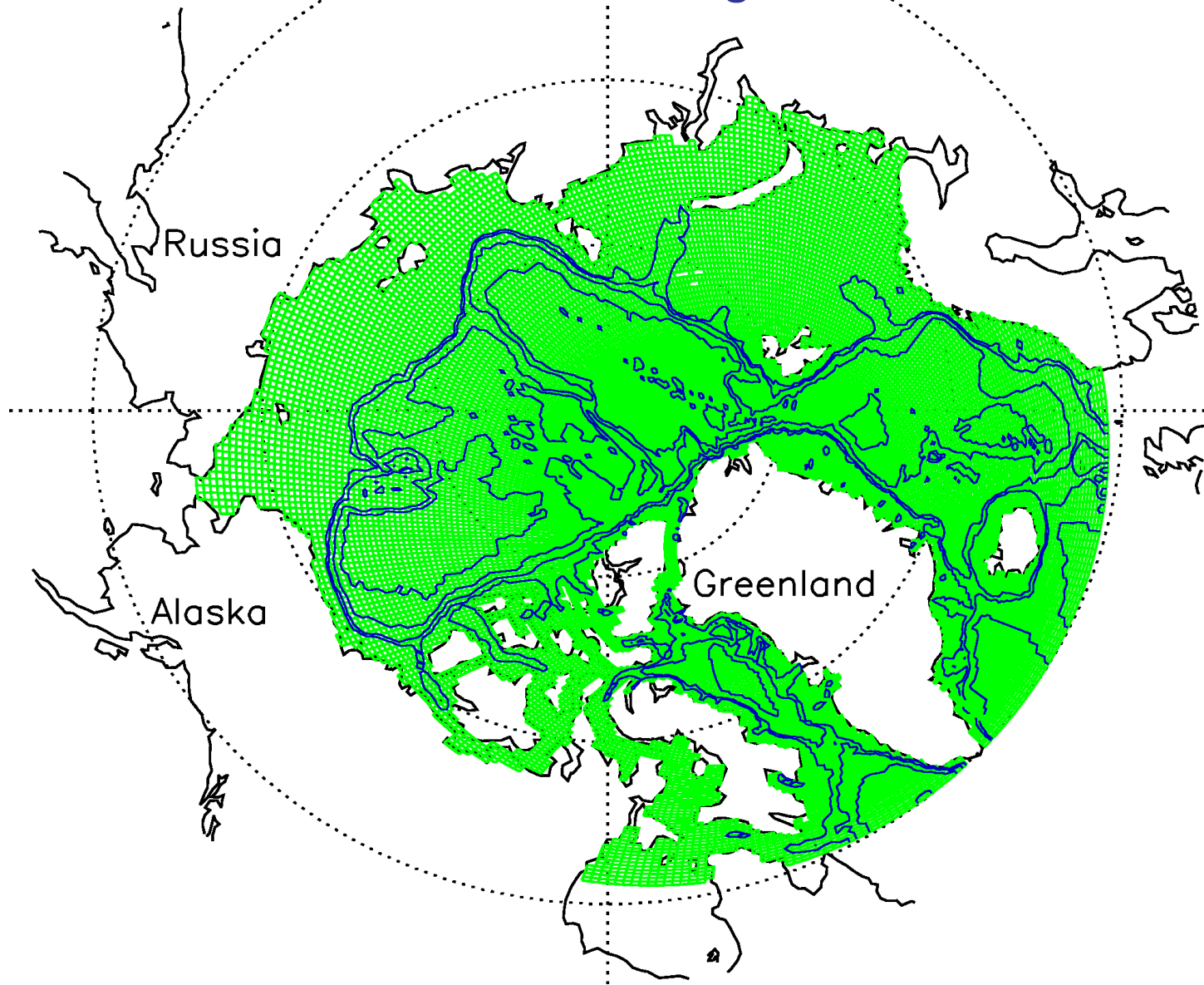
# Scientific Objectives

- Synthesize the historical evolution of the arctic biology, sea ice, and ocean system from 1979 to the present to understand the large-scale changes that have occurred in the sea ice, upper ocean, and, to the extent possible, the marine planktonic ecosystem over this period.
- Identify key linkages and interactions between the sea ice, the upper ocean, and the planktonic ecosystem to understand how changes in sea ice affect biogeochemical processes and food-web dynamics in Arctic shelf and basin upper ocean ecosystems and the export of OM from the upper ocean.
- Project a diminished ice cover with several warming scenarios to explore the functioning of the planktonic ecosystem in an ice-diminished or summer ice-free Arctic Ocean.

# The pan-Arctic **B**iology/**I**ce/**O**cean **M**odeling and **A**ssimilation **S**ystem (**BIOMAS**)

- Synthesis and modeling of the Arctic Ocean physical-biological processes.

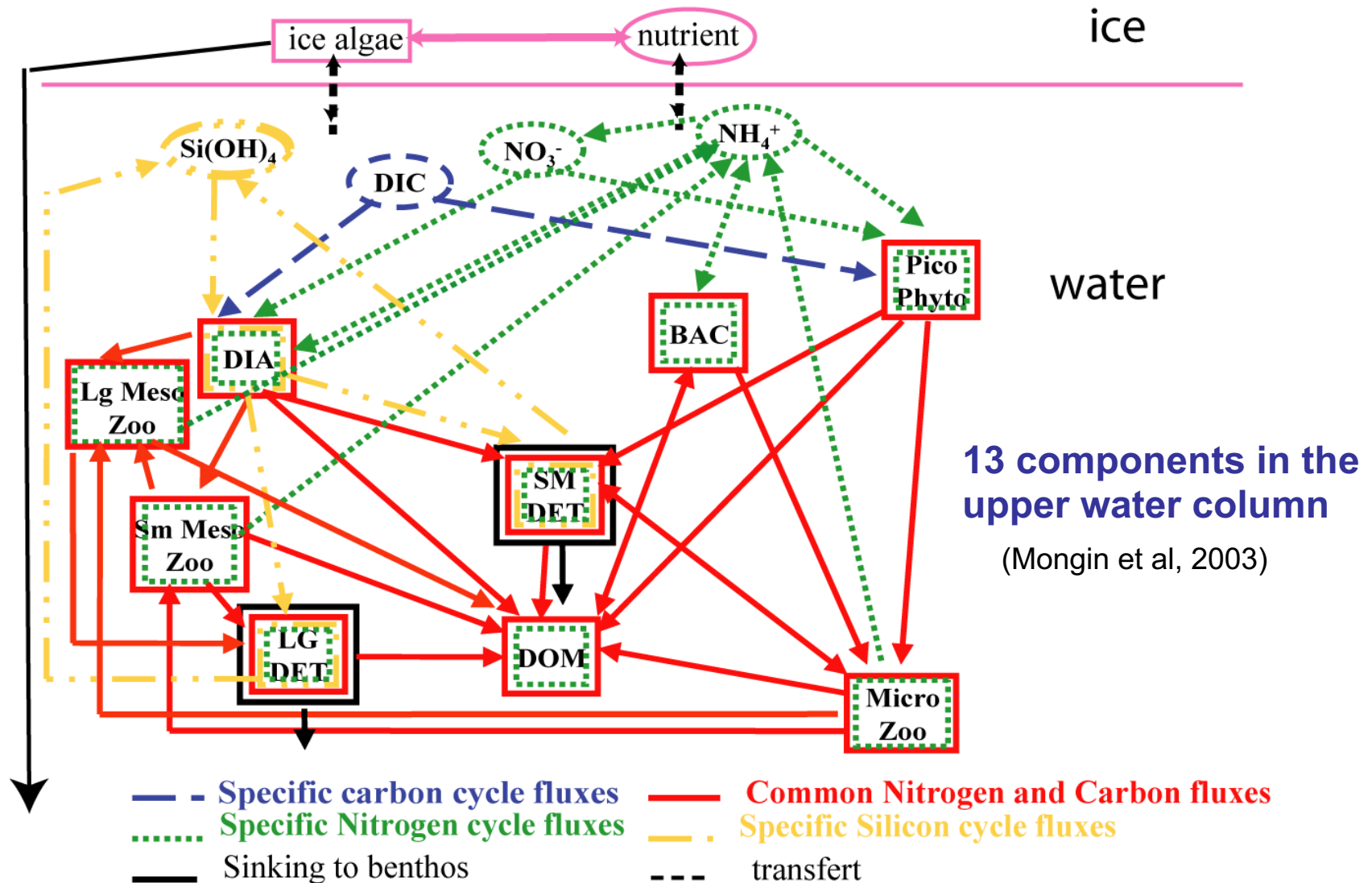
## BIOMAS Grid Configuration



# BIOMAS Model Components

- **Parallel Ocean and Ice Model (POIM, Zhang/Rothrock 2003).**  
  
**=> Dynamic thermodynamic sea ice model (Zhang/Hibler 1997).**  
  
**=> POP (parallel ocean program) ocean model (Smith et al. 1992).**
- **Marine planktonic ecosystem model (Spitz et al. 2001).**

# Schematic of BIOMAS Ecosystem Model



# Work Completed for Developing BIOMAS

- Configuration of the physical model, the POIM.
- A simple NPZD 4-component ecosystem model as in ROMS (Powell et al. 2006).
- A 11-component ecosystem model (Spitz et al. 2001).
- Test runs.

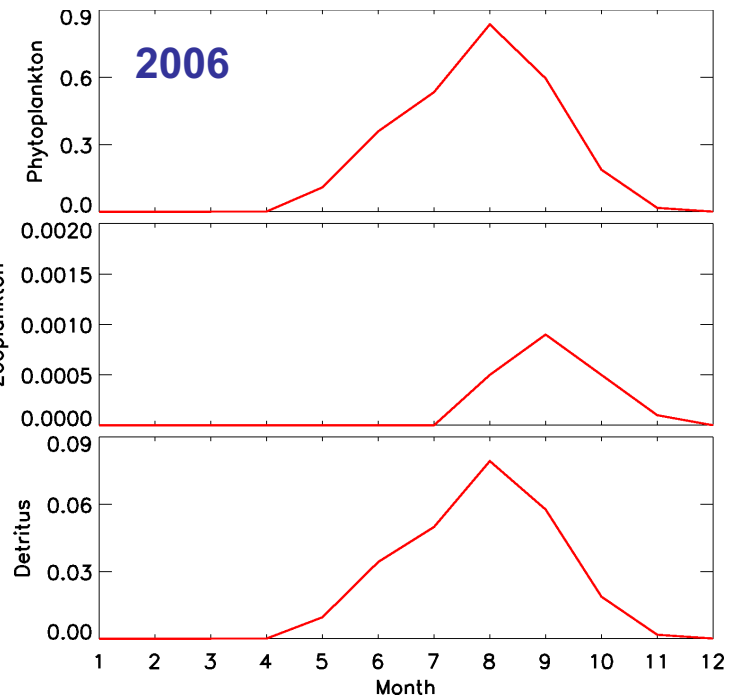
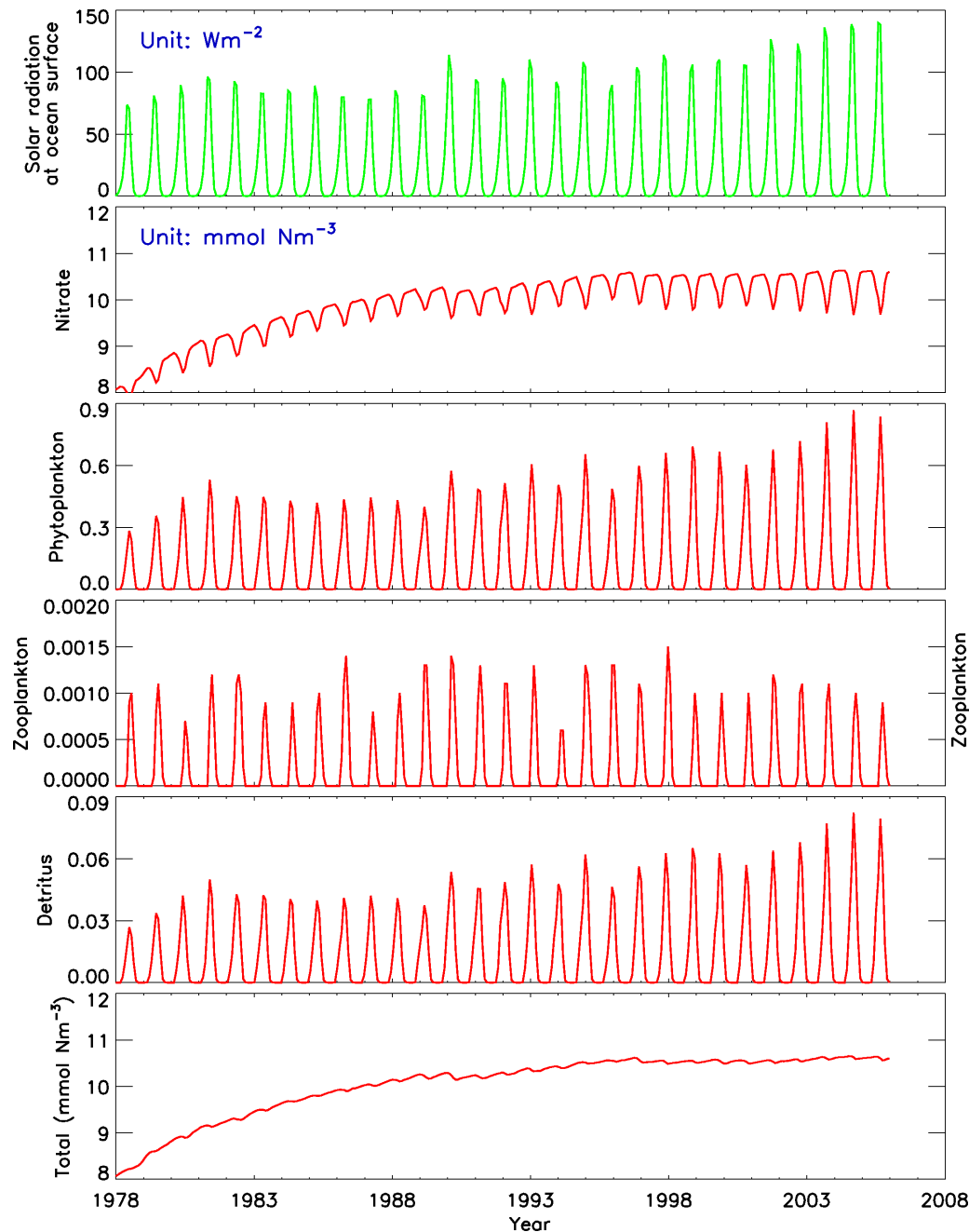
(NPZD = nitrate, phytoplankton, zooplankton and detritus)

# **Preliminary BIOMAS Results**

**(Testing BIOMAS with the NPZD and the 11-component ecosystem models in a fully coupled setting)**



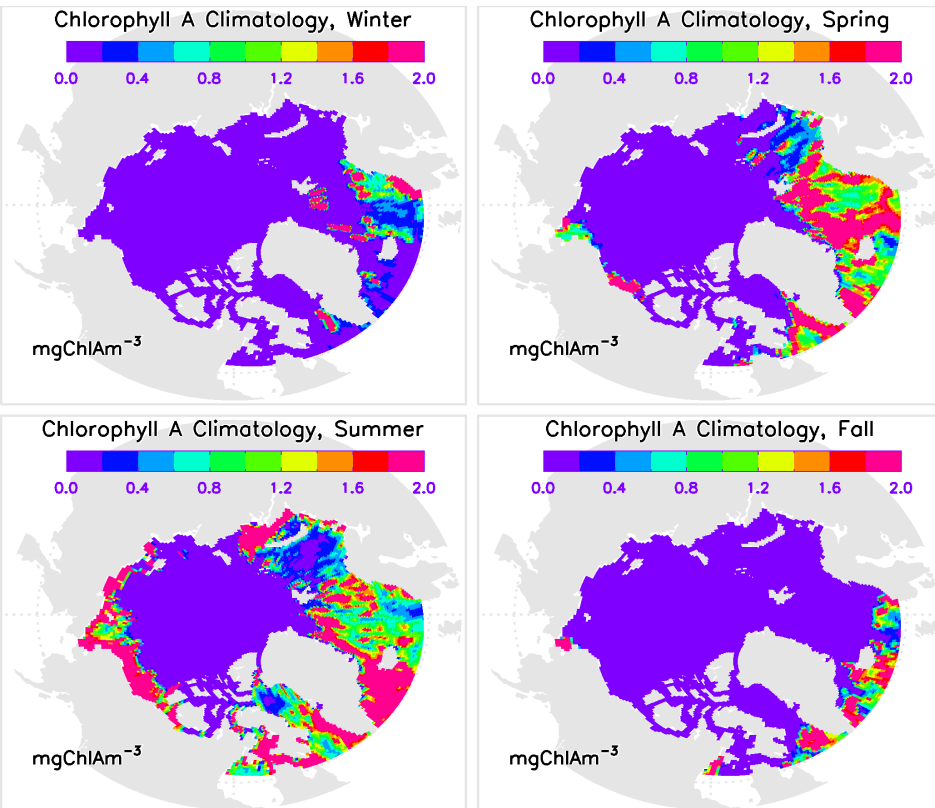
## Changes of NPZD in response to changes in surface solar radiation



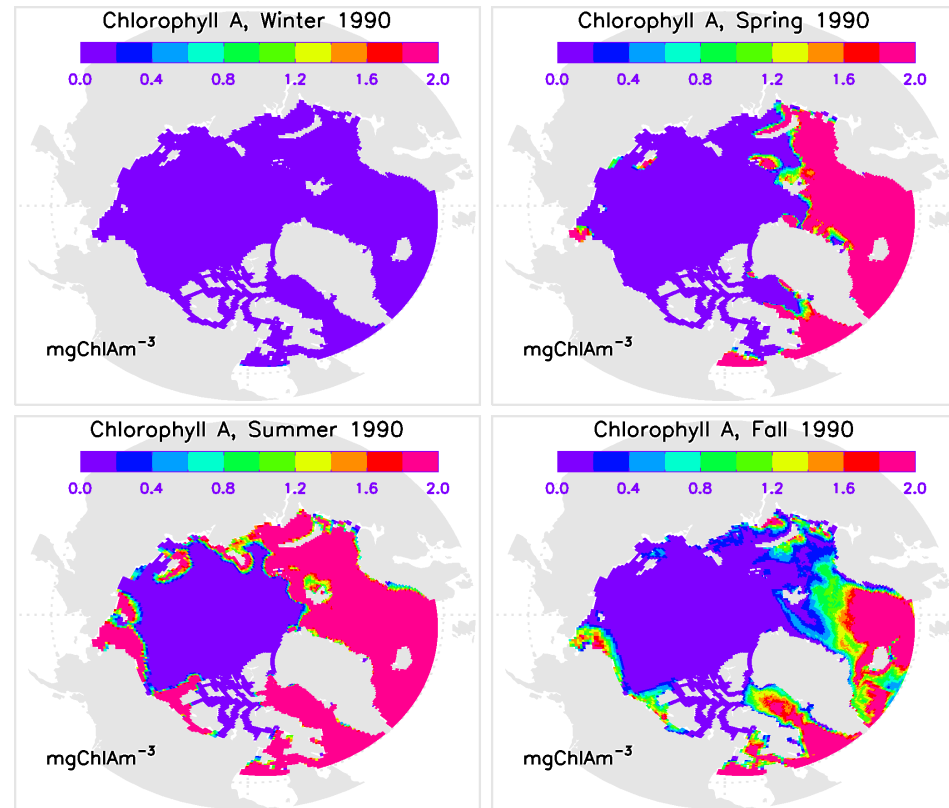
**Averaged in the upper  
100 m of the Arctic Basin  
and Barents Sea.**

# Spatial distribution of chlorophyll a

## Observations

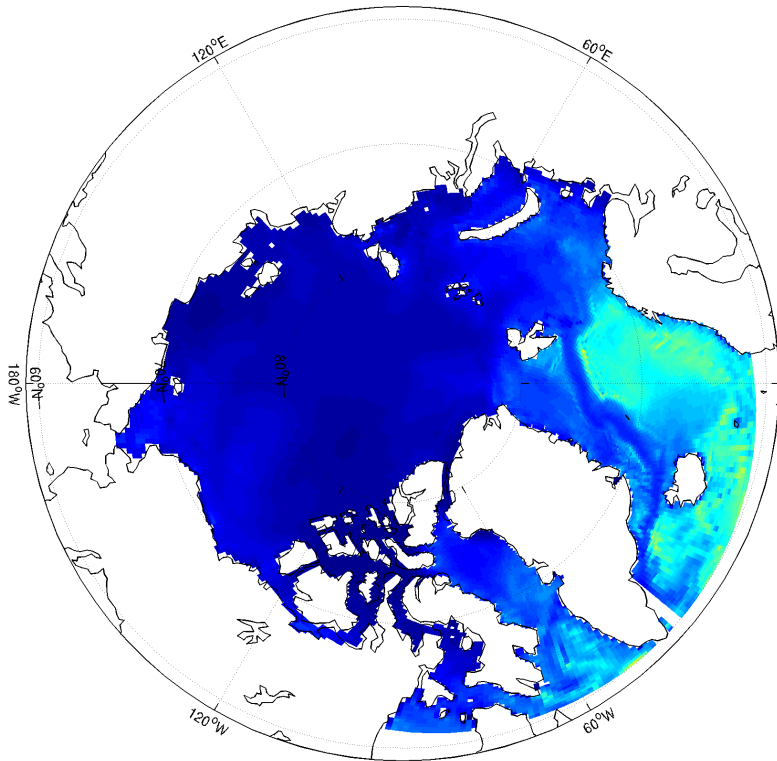


## Test results (NPZD model)



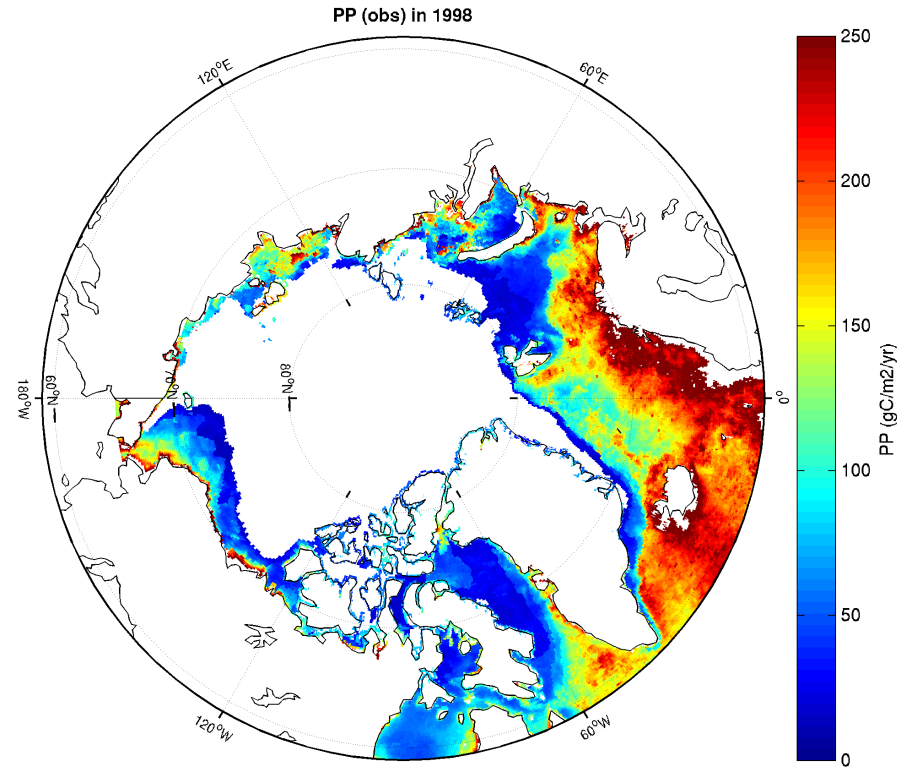
*Gregg/Conkright, 2000*

# Annual primary production



Model 1986

**11-component model**



VGPM 1998

(Behrenfeld and Falkowski. 1997)

**Observations**

# **Work in the next year**

- **Model calibration and validation.**  
=> Interacting with Matrai et al. project and other SASS projects for data support.
- **Continue to develop the biological model and improve the physical model.**
- **Production runs.**

**Thank you!**

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